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Benefits and application of Rice Husk Biochar

by leveraging local agricultural resources in Liberia

March 2022

Rice as a staple crop in Liberia

Rice ís the major staple food in Liberia. Production and demand are large in volume but are subject to avoidable risks

- **Agriculture & Forestry** is the primary livelihood for more than **60% of Liberia's population → 31% of Liberia`s GDP**[1]
- Main agricultural produce include: **rice**, **cocoa,** casava, sugarcane, palm oil and rubber
- Overall agricultural productivity is low: Poor integration, **lack of basic infrastructure** (machines / farming equipment / access to roads) and **fertilizers/irrigation**
- **Main cash crops** are **cocoa**, timber, palm oil and timer

Rice

- Compared to the processing of other Liberian produce, rice milling is more sophisticated, but rice is primarily grown for own consumption
- Annual per capita consumption of rice → 130kg/year (highest level in Africa). To meet demand **300.000 metric tons are imported annually at a price of USD 200/m**[3]
- **Rice** production in Liberia: **>240.000 t/a → Rice Husk**, a by product of rice processing: **ca. 48.000t/a**[6]
- Largest industrial **rice processing facility** in Liberia → **ca. 150 t/month**[5,] by Fabrar Liberia Inc. (mainly red rice) → processes include **parboiling**, **drying**, **husking**, cleaning. polishing and packaging

Need for local charcoal substitution
Biochar a potential solution?

- Liberia's forests make up >2/3 of the country
- >50% of Liberia's population lives within 2.5km of a forest
- 35% of this group`s income is from collecting and selling forest products
- Charcoal serves as the primary energy source for Liberians (61% in rural areas & 8% in urban areas)
- Especially for cooking, charcoal is the cheapest energy source at USD 2 cents per unit of energy
- Charcoal for cooking is also popular due to taste and cultural reasons
- There is a direct correlation between charcoal production and forest degradation and deforestation. Thus, the current way of charcoal production is unsustainable
- Currently there is no affordable and acceptable alternative in the market

Sources:
World Bank Document
"Community Forest in Liberia: The Interface between Sustainable Charcoal" by Amavie Clement (sit.edu)
Woodfuel review and assessment in Liberia (fao.org)

Rice husk and other suitable feedstock options for biochar

Cocoa Shells

Macadamia Shells

Rice Husk

Palm Waste

Coconut Husks

Corn Cobs

Nut Shells

Bagasse

Tea Cuttings

Cassava Waste

Cotton Waste

Forestry Waste

Cocoa shell to Biochar Facility in Hamburg, Germany

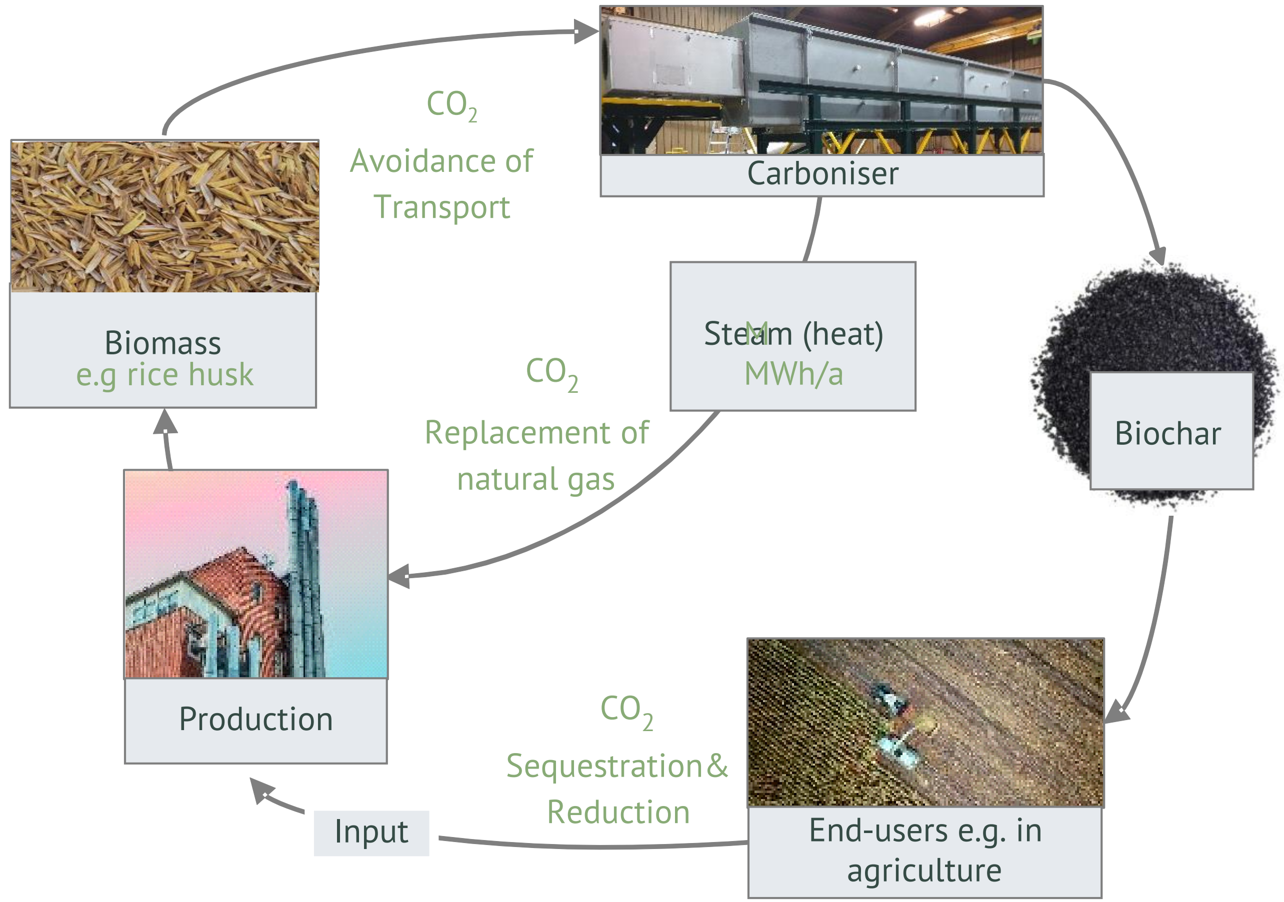
Circular Carbon's first biochar system has an output capacity of 3.500 t/a

Rice-Husk-Biochar towards increased agricultural productivity

Circular Carbon and Biochar's as a Nature-Based-Solution

- **Biochar** made **from agricultural waste** has been shown **to improve soils, increase crop yields** through **enhanced water retention ability** and has an extremely high affinity of nutrients. Biochar also **reduces the need for agrochemicals such as fertilisers** (even more significantly in arid soils)
- In addition, Biochar expands the soil carbon pool, **acting as a carbon sink, reducing the agricultural sectors' Green House Gas Emissions**. The production process for Biochar simultaneously serves as **a source for renewable heat production** and has significant decarbonising effects when applied in a variety of value chains

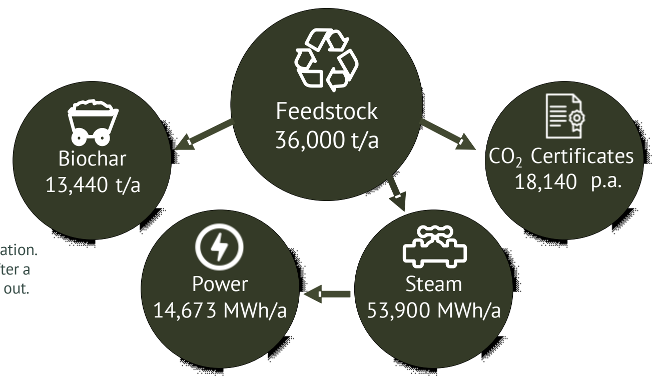
An Illustration of the Circular Economy Model



Value of Rice-Husk-Biochar

Food Processing plays a minor role in the current economy. Majority of agricultural outputs is exported to neighboring countries

Estimates of ADDED VALUE OF BIOCHAR PRODUCTION



Disclaimer: This is a rough calculation. Exact details are only possible after a feasibility study has been carried out.

✓ **Value of Biochar**: $12,620,590

(Calculated with $939 per ton)

✓ **Value of Certificates**: Depending on final Art 6 outcomes and frameworks

BENEFITS OF APPLICATION OF RICE HUSK BIOCHAR

- The combination of 2.5t/ha rice husk Biochar + 2.5t/ha compost treatment gave the **highest dry grain yield reaching 103.8%** compared to compost treatment only increased by 76.9% compared to control treatments (without Biochar and compost)
- **Application of 5t/ha increased nutrient uptake, efficiency use and dry matter production of rice plant**
- Biochar made from rice husk grown in acid sulphate soil and other organic soil amendment applications significantly improve some properties of the acid sulphate soil: **decreasing soil bulk density, soil strength, exchangeable Al, and soluble Fe, and increasing soil pH, soil organic matter, total P, CEC, exchangeable K, and exchangeable Ca**.
- The improvement of soil properties with organic soil amendment applications results in an **improvement of rice growth** as shown by an increase in plant height and dry biomass
- The application of 3t/ha of charcoal over 5 years **saves >1t of phosphorus & nitrogen fertilizer per year per hectare**.
- Rice Biochar can be used in 3t/ha to help **improve rice resilience to drought**.
- Use of rice husk Biochar can **promote soil carbon sequestration**

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Material risks and mitigants

Category	Risk	Mitigant
Project risks	Feedstock risk	Secure long-term (10+ years) biomass stream for pyrolysis input, for example secure 75% of annual rice husk / biowaste in Liberia
Project risks	Counterparty risk	Contractual agreement with at least one offtaker with an acceptable credit risk score, for the off-take of steam and/or biochar to make the project economically viable/bankable
Macroeconomic risks	Political risk	Rule of Law, clear policies on land rights and taxes (double taxation treaties, income tax) Mitigation via political risk insurance cover (e.g. MIGA/World Bank)*
Macroeconomic risks	Currency risk (if FDI)	Economic and fiscal policies supporting the local currency and its transferability Purchase of hedging instruments (TCX and other institutions)
Other material risks	Lack of Logistics and Regulatory Framework	Trade policies supporting exports and import of materials and products (customs/duties) Cooperation with local logistics companies and dialogue with government (road uptake)
Other material risks	Social and environmental risk	Obtaining social and environmental assessment prior to investment
Other material risks	Weather risk (floods, droughts)	Purchase of weather and yield insurance*
Other material risks	Price risk (Input + Output)	Long term offtake agreements for biochar or steam (see above)
Other material risks	Technology Risk	None. Proven technology known to mankind for ~2,000yrs

* If available and economically viable

Key Enabling Policy Requirements to increase Technology Transfer and Foreign Direct Investments

Rule of Law, clear policies on land rights and taxes
(double taxation treaties, income tax)

Economic and fiscal policies supporting the local currency
(transferability and convertability)

Trade policies supporting exports and import of materials and products
(customs/duties)

Get in touch

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Disclaimer: